F 3659 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Electronics and Communication Engineering

EC 010 505 – APPLIED ELECTROMAGNETIC THEORY (EC)

(New Scheme – 2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. State and explain Lorentz Gauge condition in detail.
2. Define and explain the types of Polarization.
3. What are dominant and degenerate modes? Explain.
4. Which mode offers wide tuning range in a circular cavity resonator? Why? Explain in detail.
5. Derive the input impedance of a $\lambda/2$ transmission line. Assume the line is lossless.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Derive the capacitance of a co-axial line. Explain the steps.
7. Derive Maxwell's equations in integral form.
8. Prove that TM_{01} does not exist in a rectangular waveguide. Justify your answer.
9. Define and explain the Q factor of a cavity resonator.
10. Explain the concept of impedance matching in Single stub tuner with a diagram.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (i) State and derive Gauss divergence theorem.

    (ii) Derive the inductance of flat line. Explain the differences between co-axial line and two wire transmission line.

Or

Turn over

12. (i) Derive the equation of continuity.

(ii) Derive the energy stored in electric field.

(iii) State and derive Stoke's theorem.

13. (i) State Poynting theorem. Derive the equation of complex vector. Explain its applications.

(ii) Explain the characteristics of uniform plane waves.

Or

14. (i) Explain the reflection and refraction of plane waves by conductor and dielectric.

(ii) Define and explain Skin depth. Explain its significance. Derive an expression for skin depth.

15. (i) Explain the characteristics of TM waves. Derive their characteristic equations.

(ii) Discuss the excitation of modes in rectangular waveguides with neat diagrams.

Or

16. (i) Defie and explain : (a) Cutoff frequency ; (b) Wave impedance ; (c) Surface resistance ; and (d) Characteristic impedance.

(ii) When a wave of 6 GHz propagates in parallel conducting plates separated by 3 cm, find the v_p and v_g of the wave for the dominant wave.

17. (i) Explain the significance of Bessel functions in circular waveguide analysis, with an example.

(ii) Mathematically prove that the dominant mode for circular waveguide is TE_{11}.

Or

18. (i) Design a rectangular cavity to have a resonant frequency of 9.8 GHz, having dimensions $a = d$ and $b = a/2$.

(ii) The resonant frequency of a cavity is 8.8 GHz. It is critically coupled to an external circuit. The measured bandwidth with loading is 4 GHz. Calculate the loaded and unloaded Q's.

19. (i) Derive standard Smith chart equations. Explain the applications of Smith chart with examples.

(ii) Derive standard transmission line equations.

Or

20. (i) Define and explain : (a) Characteristic impedance ; (b) Transfer impedance ; (c) Propagation constant ; and (d) Reflection coefficient.

(ii) Derive the input impedance of a lossless line. For a shorted section of 75 ohm transmission line, $l = \lambda/4$, find the input impedance assuming $\alpha = 0$.

($5 \times 12 = 60$ marks)